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Insect Diet Dispenser for Medium-Size Rearing Programs

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Insect Diet Dispenser for Medium-Size Rearing Programs

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ABSTRACT

A dispenser for agar-base diets was designed and built to dispense a precise amount of diet per container. The unit, which costs about $1,300 (1977 prices), consists of a pipetting machine equipped with a stainless-steel large-valve syringe that is capable of dispensing 5 to 20 ml of diet per delivery, a 2½-gal stainless-steel tank, and a mobile cart. Uniform volumes of up to 130 ml per delivery can be obtained by using larger syringes, thus increasing the unit's versatility. This durable dispenser is simple to operate, sterilize, and maintain, and it shows promise for use in many future insect-rearing programs. KEYWORDS: insect diets (agar-base), insect diet dispenser, insect-rearing equipment.

INTRODUCTION

Our method of dispensing agar-base diet for the southwestern corn borer, *Diatraea grandiosella* (Dyar), worked fine for a small rearing program (Davis 1976). However, the procedure of dispensing the diet into rearing cups by hand with polyethylene squeeze bottles had its limitations when the size of the operation was expanded. Some of the disadvantages of this procedure were frequent refilling of bottles, handling of hot bottles, large work area required to spread out cups, no uniformity in amount of diet per cup, waste caused by diet solidifying to funnel and bottles, and difficulty in cleaning and sterilizing bottles.

Several inexpensive diet dispensers have been described. Burton et al. (1966) modified a pressure cooker to dispense agar-base diets. Similarly, Patana (1967) modified a pressure paint tank for dispensing insect diets. Both of these devices require air pressure, regulators, and an air-filtering system. They also use a modified sink-spray hose in an attempt to control the amount of diet per rearing container, resulting in unequal amounts of diet per container.

Sparks and Harrell (1976) summarized mechanized rearing of the corn earworm, *Heliothis zea* (Boddie), at the Southern Grain Insects Laboratory, Tifton, Ga., from 1968 through 1974. Initially, production was only a few hundred insects per day, but it increased to about 120,000 per day. Their mechanized rearing program reached the point where a modified in-line form-fill-seal machine formed the rearing cells, filled the cells with diet, infested the diet with corn earworm eggs, and finally sealed a top over the rearing cells. Most research programs do not require large enough numbers of insects to justify such equipment.

Our objective was to develop a relatively inexpensive, durable dispenser that would be simple to operate, sterilize, and maintain and one that would dispense a precise amount of diet per container. This report describes a dispenser for agar-base diets that we developed to meet these objectives.

DESIGN, COST, AND CONSTRUCTION

Basically, the unit (fig. 1) consists of a Scientific Equipment Products model 40 pipetting machine

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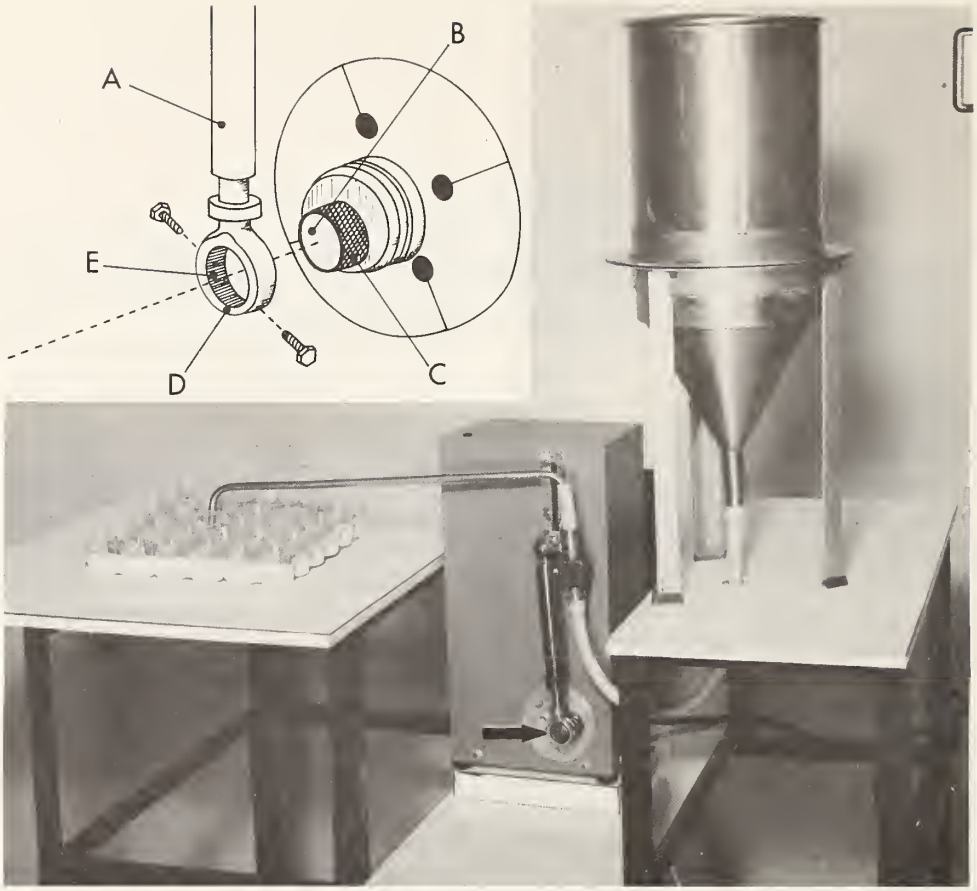

Figure 1.—Insect diet dispenser. A, Syringe. B, Eccentric post. C, Stainless-steel sleeve. D, Adapter ring. E, Stainless-steel needle bearing.

equipped with a stainless-steel large-valve syringe (A) that is capable of dispensing 5 to 20 ml of diet per delivery, a 2½-gal stainless-steel tank, and a mobile cart. The complete dispenser costs about $1,300, based on prices for 1977.

Several minor modifications of the pipetting machine were necessary to make it work efficiently. Apparently, our diet was so viscous that the machine was under stress, resulting in damage to a major gear within the machine. This problem was caused by friction buildup where the pipetting machine connects to the syringe (see arrow in fig. 1). The problem was solved by modifying the attachment system. First, we ground down the end of the eccentric post (B) to fit the inside diameter of a hardened stainless-steel sleeve (C) and placed the sleeve on the post. Then we removed the stainless-steel bearing from the adapter ring (D) of the syringe and inserted a stainless-steel needle bearing (E) in its place.

A stainless-steel tube (⅜-inch o.d., ¼-inch i.d.), bent at a 90° angle at each end, was inserted at one end in the outlet of the pipetting machine to transfer the diet from the pipetting machine to the rearing containers. A section of rubber tubing was used to hold the tube in place.

The diet tank was constructed from a cylinder that was obtained by cutting off the bottom of an 8¼-qt stainless-steel beaker (8¾-inch diameter, 9¾-inch height) and welding it to the top of an 8¾-inch-diameter stainless-steel funnel. A metal ring was welded around the outside of the cylinder to hold it on a metal stand.

The 54- by 28- by 37-inch cart was constructed of 1¼-inch angle iron. Casters were put on the cart for mobility. The top of the cart consists of three platforms constructed of ½-inch plywood covered with Formica. The two outer platforms, for dispensing and for holding the tank, are 1 foot higher than the center platform (fig. 1). Thus, the pipetting machine can be raised or lowered to allow for dispensing diet into various size containers, including vials.

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OPERATION AND MAINTENANCE

Just before the dispenser is used, about 1 gal of hot water is pumped through the system to heat it and thus prevent solidification of diet, a problem that could occur in a cold system. The diet is then poured into the tank and dispensing begun. The dispenser is controlled by a foot switch. The motion of the syringe causes the dispensing tube to move up and down. When the tube is in the "up" position, the operator centers a cup under it. The tube then comes down and the cup is filled with a precise, specified amount of diet. As the tube rises again, another cup is centered for filling. At a flow rate of 75 deliveries per minute, an operator can dispense 1 gal of diet every 7 minutes.

When diet dispensing is completed, the dispenser is immediately flushed with about 1 gal of boiling water to remove diet residue left in the system. The dispenser is then sterilized by flushing the system with approximately 1 gal of 10-percent Chlorox solution. Another gallon of water is put through the system to remove the Chlorox. In accomplishing these cleanup steps, the dispenser pumps the various solutions into a sink.

Some daily maintenance to the pipetting machine is required. The O-rings within the syringe must be greased with a thin layer of vacuum grease after operation each day or after dispensation of 4 gal of diet. The O-rings should be replaced once each month.

Our dispenser has proven to be durable and is easy to operate and maintain. Also, uniform volumes of up to 130 ml per delivery can be obtained by using larger syringes, thus increasing its versatility. We feel that this dispenser could be used in many insect-rearing programs.

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